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(54) **Device for moving and guiding a motion-picture film**

(57) A device for moving and guiding a motion-picture film (1) through the film gate of a telecine scanner comprises a carriage (12) which is moved in a longitudinally direction w.r.t the film so as to effect scanning on which carriage (12) each film frame is immobilised during the uniform forward movement. The drive means for the carriage comprises a motor-driven cam (21) having a sawtooth-shape (17) with sinusoidal transitions and two latching positions.

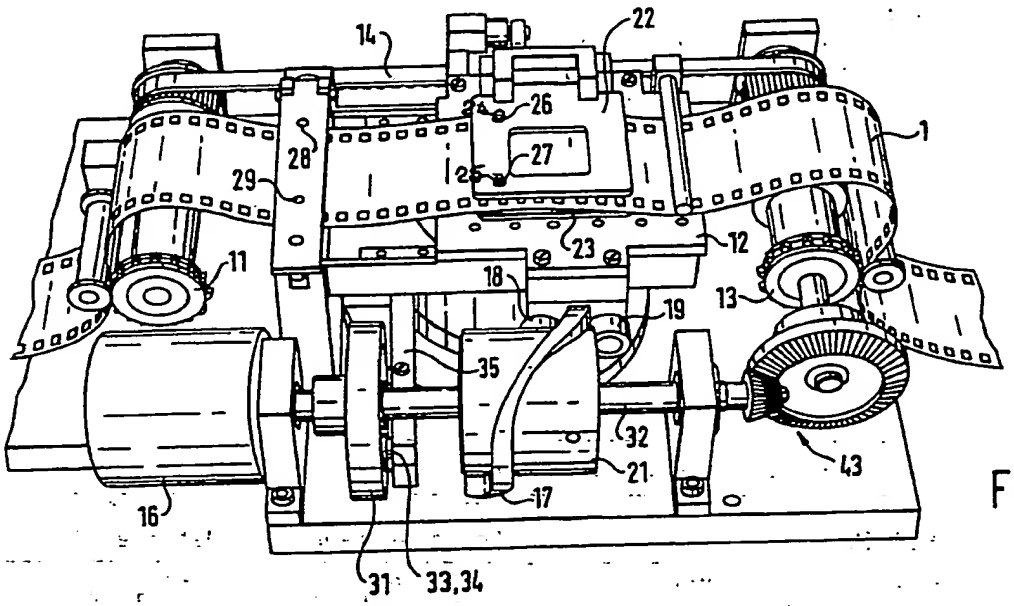

FIG. 2

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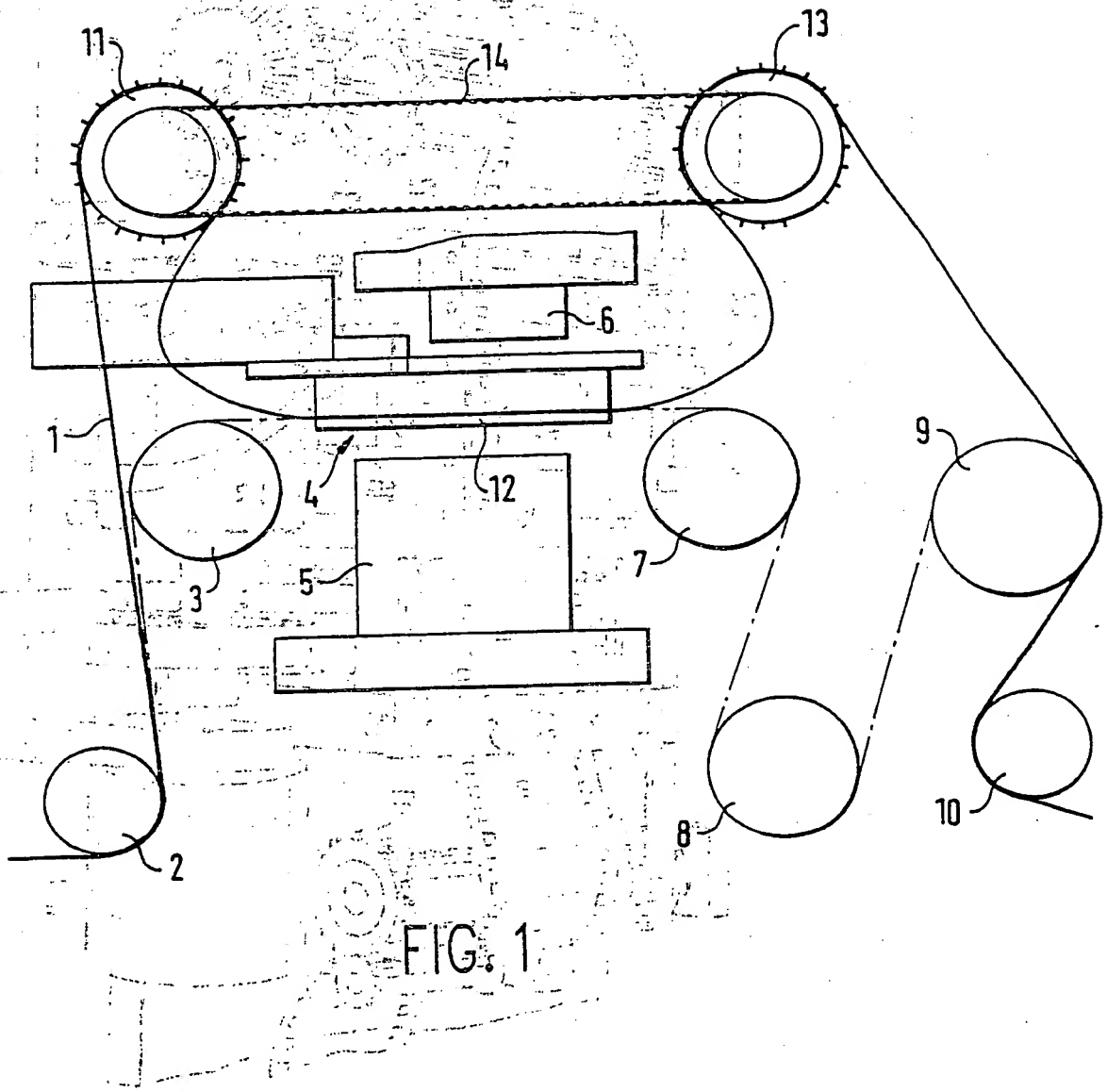


FIG. 1

FIG. 2

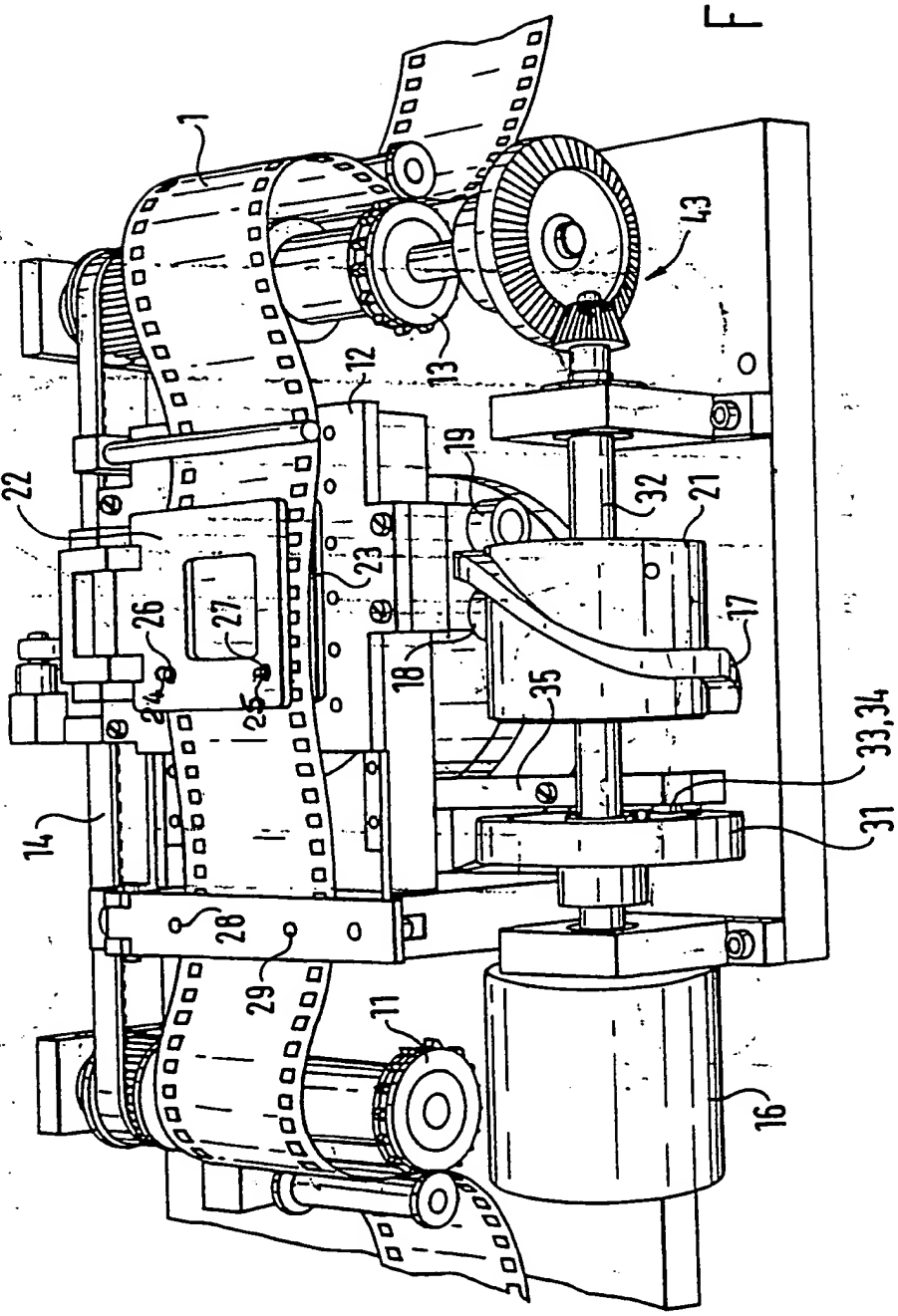
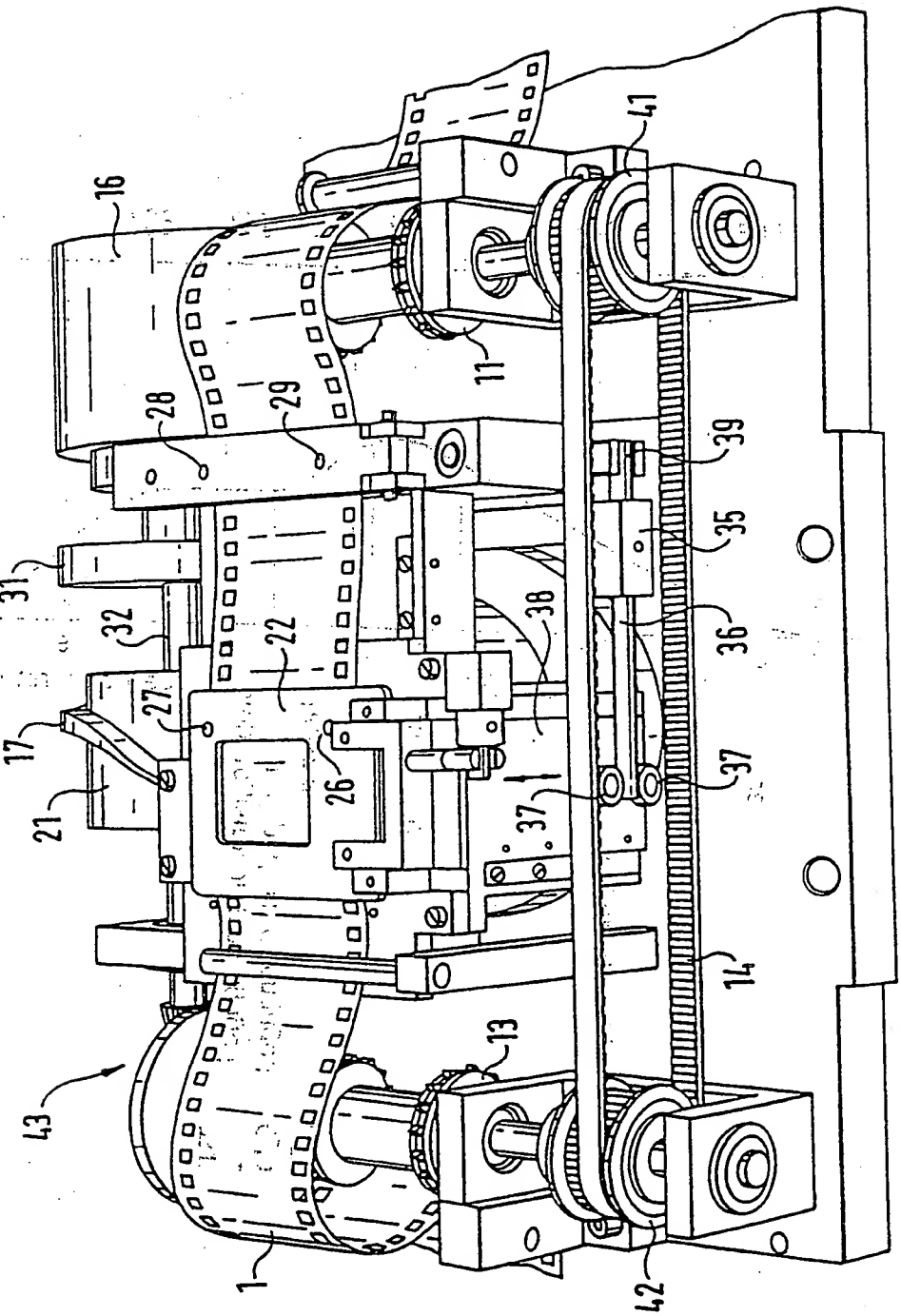


FIG. 3



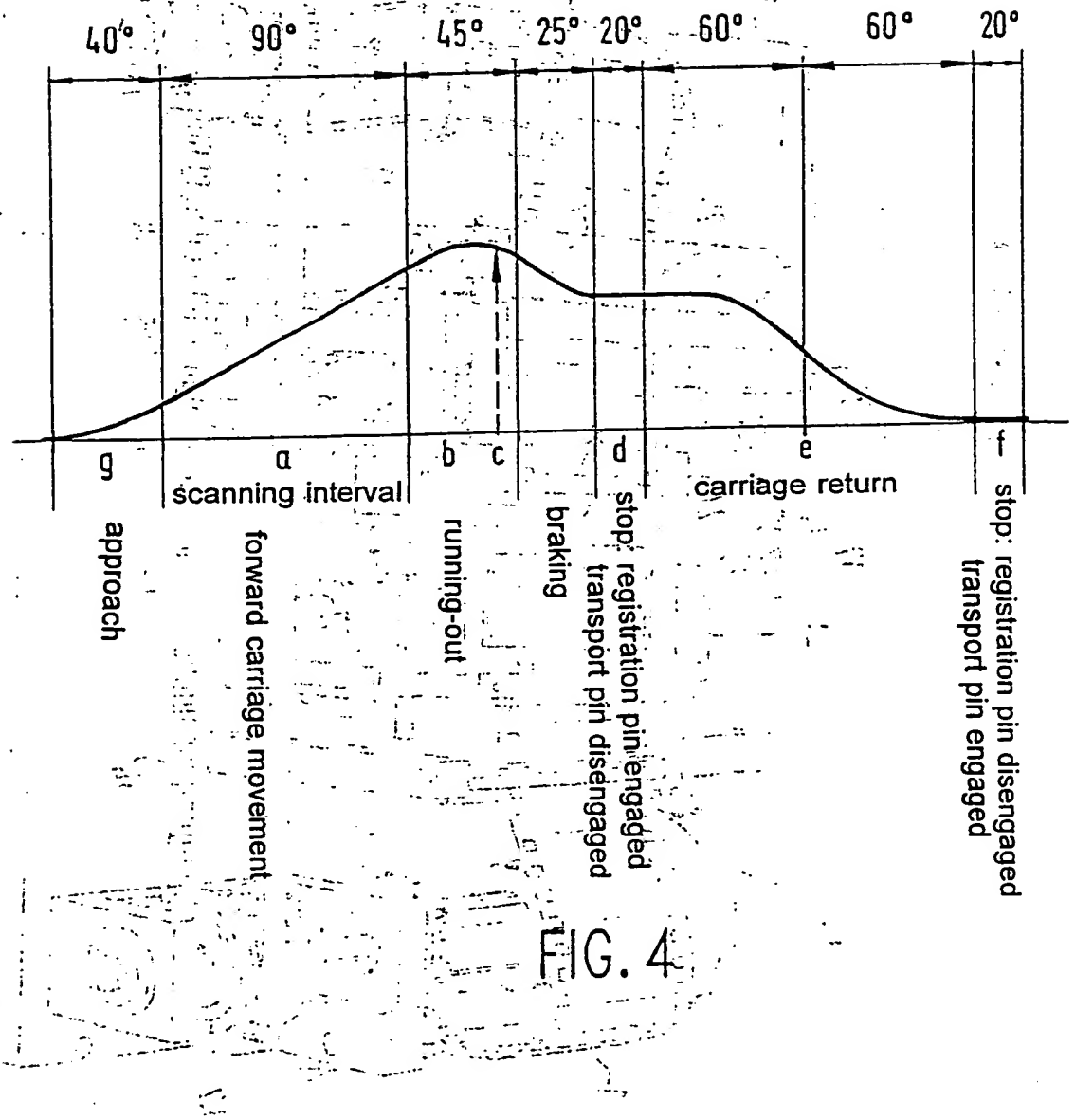

40°
90°
45°
25°
20°
60°
60°
20°
g
a
b
c
d
e
f
scanning interval
carriage return
approach
forward carriage movement
running-out
braking
stop: registration pin engaged
transport pin disengaged
stop: registration pin disengaged
transport pin engaged

FIG. 4

DESCRIPTION

DEVICE FOR MOVING AND GUIDING A MOTION-PICTURE FILM

The invention relates to a device for moving and guiding a motion-picture film with sprocket holes through the film gate of a telecine scanner.

When motion-picture films are scanned synchronisation errors arise, for example, as a result of transport fluctuations, dynamic variations in film traction owing to the elasticity of the film stock and, in particular, frame misalignment on the film. These errors may lead to visible horizontal and vertical image unsteadiness. Whereas image unsteadiness tends not be annoying in the case of projection in darkened movie theatres for lack of suitable reference points, the annoying effect may increase considerably in the case television reproduction owing to the illuminated environment and the rapid alternation of electronic recorded images and film shots. Very stringent requirements are imposed on the image steadiness in the case of processes in which computer graphics are combined with film shots by means of chroma-key techniques because the relative movement of the inserted film scenes in the stationary part of the image is particularly annoying.

To mitigate these drawbacks German Utility Model G 93 07 566 proposes a device for the transport of a film through the scanning gate of a film scanner, which guarantees a stable positioning of the film frame to be scanned on a reciprocating slide. However, this known device has the drawback that the simple eccentric drive used for the slide movement only allows a sinusoidal movement without any real rest positions during slide reversal, so that owing to the continuous movement of the film the transport cycle may be disturbed again when the registration pin both engages and disengages the sprocket holes. Moreover, this is liable to

give rise to damage to the sprocket holes.

It is an object of the present invention to provide a device for moving and guiding a motion-picture film with sprocket holes through the film gate of a telecine scanner which mitigates the above-mentioned drawbacks of the known device and which gives an optimum image steadiness during scanning of the film frame with the normal film speed.

This invention provides a device for moving and guiding a motion-picture film having sprocket holes through the film gate of a telecine scanner, comprising a carriage which is rectilinearly reciprocated in a guide perpendicular to the optical path of the film gate and which carries two transport pins which are engageable in reference sprocket holes of the film and define the position of each film frame, which pins immobilise each time one film frame on the carriage for the scanning process during the uniform forward movement of the carriage in which the drive means for the carriage comprises a motor-driven cam having a sawtooth-shape with sinusoidal transitions and two latching positions, the linearly rising portion of the sawtooth serves to generate a constant driving speed corresponding to the real film speed, the sinusoidal transitions serve to generate an approach phase and a running-out phase, and one of the two latching positions, which serve to interrupt the carriage movement, precedes and the other follows the linearly rising portion.

The device in accordance with the invention has the advantage that owing to the specially shaped cam the carriage performs a so-called pilgrim-step movement, which results in a drive speed corresponding to the actual film speed.

Moreover, it is advantageous that a uniform driving torque is obtained because no springs have to be tensioned and relaxed over a stroke. In addition, higher driving speeds can be handled without any undesired oscillations of springs and masses.

Advantageous modifications and improvements of the device defined in the main Claim can be obtained by means of the steps defined in the subsidiary Claims.

A special advantage is that a tension-free film loop is situated before and after the carriage, as a result of which the film frame being scanned is free from its environment - with respect to tension, guidance - and is positioned only by the transport pins of the carriage. This enables the film frame to be moved freely by a few tenths of a millimetre in the x direction and the y direction and, in addition, to be rotated in the X/Y plane. The film loops should be dimensioned in such a manner that the reciprocating movement of the carriage is not obstructed.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a basic diagram of the film transport path in a telecine scanner,

Figure 2 shows a device in accordance with the invention viewed from the front,

Figure 3 shows a device in accordance with the invention viewed from the rear,

Figure 4 is a diagram of the carriage transport curve.

Like parts in the Figures bear the same reference numerals.

In the film transport path shown in Figure 1 a motion-picture film 1 is led from a feed spool (not shown) to a sprocket roller 3 *via* a deflection roller 2, subsequently to a film-drive capstan 9 *via* a scanning station 4 comprising an illumination device 5 and a pick-up device 6, in which the film is scanned, *via* further deflection rollers 7 and 8, and finally to a take-up spool, not shown, *via* a further deflection roller 10.

When the transport device in accordance with the invention is used

the film is no longer fed through the scanning station 4 *via* the rollers 3 and 7 but is fed to the transport carriage 12, by means of which the film is fed through the scanning station, *via* an additional sprocket roller 11, by means of which a film loop is formed, and to a second additional sprocket roller 13, by means of which another film loop is formed.

During the scanning process a film frame, immobilised on the carriage 12, is moved from the left to the right by this carriage, after which the carriage 12 returns to its initial position upon disengagement of the film, immobilises the next film frame, and is again moved to the right for scanning. The carriage thus produces a pilgrim-step film transport movement to the right. The sprocket rollers 11 and 13, which are coupled to one another without slippage by means of a toothed belt 14, are moved with such a constant average speed that the length of the film loop formed when the film is threaded remains constant.

In normal operation the film 1 is passed through the scanning station, not shown in the Figure, from left to right viewed in Figure 2, the sprocket rollers 11 and 13, which are driven with the average film speed, each maintaining a film loop before and after the scanning station in the film transport direction. In this way the reciprocation of the carriage 12 and the corresponding discontinuous movement of the film 1 are isolated from the continuous movement of the film 1 provided by the capstan.

The carriage is driven by means of a carriage drive motor 16 *via* a cam 17 which cooperates positively with ball-bearing 18, 19 mounted on the carriage 12. The cam 17 is formed as a curved endless ridge on a drum 21. In the diagram shown in Figure 4 the cam profile 17 produces a motion which has a sawtooth shape with sinusoidal transitions and two latching positions.

On its upper side the carriage 12 carries two frame-shaped flaps

22, 23 between which the film 1 extends. Two holes 24, 25 have been provided in one of the limbs of each of the flaps 22, 23 so as to coincide and are engageable by two transport pins 26, 27 secured to the carriage 12.

When the forward movement of the carriage 12 begins, *i.e.* at the beginning of the scanning interval of the film frame, the flaps 22, 23 are lowered to move the film 1 against the transport pins 26, 27, which then engage so-called reference sprocket holes, for example in accordance with Mitchell or Bell & Howell. The film 1 is thus retained on the carriage 12 during the forward movement of the carriage. At the end of the scanning interval the flaps 22, 23 are lifted, the film 1 being lifted off the transport pins 26, 27 by the lower flap 23.

During the return of the carriage 12 the flaps 22, 23 and the hence the film 1 remain in the lifted position so that the transport pins are disengaged from the film 1. During the return time the film 1 is retained by means of two registration pins 28, 29, which engage in corresponding sprocket holes.

Both the flap and the registration pin movement are controlled by means of a further cam 31 mounted on the same drive shaft 32 as the cam 17. The further cam 31 takes the form of a radial curve having two different radii and two latching positions. This cam also cooperates positively with two ball-bearings 33, 34 whose movements are transmitted to a linkage 35. The linkage 35 produces a simultaneous lifting movement of the frame-shaped flaps 22, 23 and the registration pins 28, 29, so that the registration pins 28, 29 are lifted and lowered simultaneously with the flaps 22, 23. As a result of this it is possible that in a first rest position of the carriage 12 the transport pins 26, 27 engage the sprocket hole and the registration pins 28, 29 disengage simultaneously in that the flaps 22, 23 are lowered, and in a second rest position of the carriage 12 the

transport pins 26, 27 disengage and the registration pins 28, 29 engage simultaneously in that the flaps 22, 23 are lifted.

In the view from the rear in Figure 3 the guide means of the linkage 35 is clearly visible. By means of two ball-bearings 37 the rod 36 serves primarily for guiding the reciprocating movement of the carriage 12 and for lifting and lowering the flap-actuating mechanism 38 as well as the registration-pin actuating mechanism 39.

The drive rollers 41 and 42 of the sprocket rollers 11 and 13 are coupled to one another without slippage *via* the toothed belt 14. In the present case driving is not effected *via* the capstan 9 as shown in Figure 1 but *via* the drive shaft 32 and a toothed-wheel drive 43.

Figure 4 clearly shows the sawtooth shape and the sinusoidal transitions in the carriage transport curve. The linearly rising portion *a* of the sawtooth covering 90° of the curve represents the scanning interval in which the carriage 12 with the film 1 is moved forward uniformly. At the end of the scanning interval *a* the carriage 12 moves on for a short running-out phase *b* and is subsequently braked until the reversing point *c*. This is followed by the stationary phase *d*, in which the carriage stops. At the same time the flaps 22, 23 are lifted, the film 1 is disengaged from the transport pins 26, 27 and is held on the housing by means of the registration pins 28, 29. Subsequently, in the interval *e*, *i.e.* over approximately 120° of the curve, the carriage 12 without film moves back to the second stationary phase *f*. In this phase the flaps 22, 23 are lowered again, *i.e.* the film 1 is lowered onto the transport pins 26, 27 and the frame is centred and at the same time the registration pins 28, 29 are disengaged from the film 1. After the film 1 has been engaged by the transport pins 26, 27 the carriage 12 with the film 1 is accelerated to the desired film scanning speed in the approach phase *g*, which speed should then be reached in the scanning interval *a*. The above cycle can now be repeated.

CLAIMS

1. A device for moving and guiding a motion-picture film having sprocket holes through the film gate of a telecine scanner, comprising a carriage which is rectilinearly reciprocated in a guide perpendicular to the optical path of the film gate and which carries two transport pins which are engageable in reference sprocket holes of the film and define the position of each film frame, which pins immobilise each time one film frame on the carriage for the scanning process during the uniform forward movement of the carriage in which the drive means for the carriage comprises a motor-driven cam having a sawtooth-shape with sinusoidal transitions and two latching positions, the linearly rising portion of the sawtooth serves to generate a constant driving speed corresponding to the real film speed, the sinusoidal transitions serve to generate an approach phase and a running-out phase, and one of the two latching positions, which serve to interrupt the carriage movement, precedes and the other follows the linearly rising portion.

2. A device as claimed in Claim 1, which further comprises registration pins which are fixed relative to the housing and which retain the film during the return of the carriage.

3. A device as claimed in Claims 1 and 2, in which during a first interruption of the carriage movement in the one latching position the registration pins are disengaged from the sprocket holes and at the same time the transport pins engage corresponding sprocket holes, and during the second interruption in the other latching position the transport pins are disengaged from the sprocket holes and at the same time the registration pins engage the sprocket holes.

4. A device as claimed in Claim 1, in which the linearly rising portion covers 90° of the cam.

5. A device as claimed in Claim 1, in which the carriage transport curve of the cam takes the form of a ridge.

6. A device as claimed in Claim 5, in which the ridge is an endless ridge formed on a drum.

7. A device as claimed in Claim 6, in which the ridge cooperates positively with two ball-bearings provided on the carriage.

8. A device as claimed in Claim 1, in which the carriage carries a pivotable frame-shaped flap which presses the film frame to be immobilised onto the transport pins during its downward movement, causing said transport pins to engage the reference sprocket holes, and which lift the relevant film frame off the transport pins during its subsequent upward movement.

9. A device as claimed in Claim 8, in which the flap movement and the registration pins are controlled by means of a control cam.

10. A device as claimed in Claim 9, in which the control cam is a radial cam having two latching positions.

11. A device as claimed in Claim 10, in which the control cam cooperates positively with two ball-bearings.

12. A device as claimed in Claim 11, in which the ball-bearings are secured to a linkage for moving the registration pins and the flap.

13. A device as claimed in Claims 5 and 9, in which the carriage transport cam and the control cam are disposed on a common shaft.

14. A device as claimed in Claim 1, in which there is provided a sprocket roller in the film transport path both before and after the carriage for the uniform transport of the film which extends as a loop between the respective sprocket roller and the carriage, in that one sprocket roller is driven with the average film speed, and in that this one sprocket roller drives the other sprocket roller *via* a non-slip toothed belt.

15. A device as claimed in Claims 13 and 14, in which the one sprocket roller is driven by the common shaft.

16. A device as claimed in Claims 1 and 10, in which the latching positions of the carriage transport cam and the control cam which concur.

17. A device as claimed in Claim 8, in which the pivotable frame-shaped flap comprises two flap sections between which the film extends and is lowered onto the transport pins by means of the upper flap section before scanning and is lifted off the transport pins by means of the lower flap section after scanning.

18. A device for moving and guiding a motion-picture film substantially as described herein with reference to the accompanying drawings.

19. Any novel feature or novel combination of features disclosed herein either explicitly or implicitly whether or not it relates to the same invention as that contained in any preceding claim.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

- 11 -

Application number
GB 9421553.0

Search Examiner
D H JONES

Date of completion of Search
15 DECEMBER 1994

Documents considered relevant following a search in respect of Claims :-
1-17

elevant Technical Fields

(i) UK Cl (Ed.M) H4F - FCD

(ii) Int Cl (Ed.5) H04N - 3/36, 3/38, 3/40, 5/253, 5/257, 9/11

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

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